TITLE OF THE INVENTION

SYSTEM TO SUPPORT MOBILE VISUAL COMMUNICATIONS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. Patent Application No. 09/564,352 filed May 1, 2000, Entitled: SYSTEM TO SUPPORT MOBILE VISUAL COMMUNICATION TECHNOLOGY, and claims priority from provisional applications 60/200,429 filed April 28, 2000, 60/209,282 filed June 2, 2000 and 60/212,959 filed June 21, 2000 further incorporated by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

N/A

BACKGROUND OF THE INVENTION

The present invention relates generally to a support system for dial-up Internet communications and specifically to a system tailored for wireless dial-up access from mobile telephone personal data organizers.

Three innovations have come of age and improve communication and data availability - the mobile telephone, the personal data assistant and the Internet. The mobile telephone has been expanding its influence and services. Such expanded services include incorporating pager functions, call waiting, caller ID and more recently a screen for a mobile telephone to allow visual communication either of text or graphics. The mobile telephone industry has developed a wireless application

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protocol (WAP) which supports integration of digital data with a wireless modem in a mobile telephone.

The personal data assistant (PDA) is becoming vital to the typical professional and useful to anyone. The PDA, while coming in various sizes, incorporates applications for addresses, schedules, to do lists, expenses and other personal services. Communication is typically through a small screen and either a touch pad or small keyboard. While common PDA's have black and white screens, trends are leading toward color screens. These two devices, the mobile phone and the PDA, are expected to merge into an extended handheld unit that will keep personal applications close to the user and allow the user to connect to the world via a wireless connection.

The Internet provides a wide variety of data sources and capabilities. HTML and XML are the standard languages used to encode and deliver these data sources. The Internet has emerged as a global communications medium enabling millions of people to share information and conduct business electronically. Its main communication route has been visual, although as the desktops, the current primary means of accessing the Internet, become multi sensory, Internet communications will shift that way too. The Internet is now supplying music like CD's and delivering messages like an answering machine. The main assets of the Internet are the ability to access a wide variety of information and the power of the search engines to find such information. The main drawbacks of the Internet have been the increasing delays in traversing the Internet due to the volume of data passing through it and the need to use a connected

computer to access the Internet. Only now are wireless modems for portable computers coming into general availability, but these are more cumbersome that the envisioned extended handheld unit.

The Internet became a common medium of communication when the speed of data transfer increased sufficiently to overcome the annoyance factor. When personal access was via the dial-up modem, at speeds ranging from 14.4 to 56 kbps, Internet use was limited to conversation and data access. As non-business usage has moved to ISDN, ASDL and cable, with speeds ranging from 128 kbps to 2 Mbps, use of the Internet has increased and applications such as audio, moving video and other real-time applications have become more prevalent.

Wireless communication speeds have not matched wired speeds. Current wireless speeds are 9.6 to 33.6 kbps, with speeds from 384 kbps to 2 Mbps projected to be delayed until after 2002. Consequently, wireless Web surfing is limited by the delays in use of the Internet more than the connected access.

Most of the current Internet Web resources are formatted for personnel desktop or laptop computer access where the resolution of the monitor and/or liquid crystal display (LCD) ranges from 640 x 480 to 1600 x 1200 pixels. The personnel computer can be equipped with a large capacity hard disk drive and a sizeable random access memory (up to 614 Megabytes). The window of each html web page is widely opened and the memory size for a page is large (up to a few Megabytes). The Internet servers for desktop users typically assume that the connection to the desktop has a high bandwidth. In fact, the bandwidth requirements for the Internet have been

pushing communications technology to provide ever more capable paths to the desktop.

Beginning efforts have been made to utilize extended mobile phones with visual screens to access the Internet. However, current wireless web surfing suffers from the slow wireless data rates, the possible intermittent nature of wireless connectivity, the long down-load time for graphic intensive pages, the cost of waiting for information to cross the Internet as the Internet becomes more congested, and from an inadequate graphical user interface.

Some efforts to alleviate the situation have been centered on wireless communications capabilities. Global System for Mobile Communication (GSM) is an extensible circuit switched technology that is the basis for most of the extensions. The Wireless Application Protocol (WAP) is optimized to work with limited display capabilities and the current generation of digital wireless systems. WAP is seen as an interim standard leading to 3rd generation (3G) capabilities. Among the most interesting 3G developments for mobile visual communications are General Packet Radio Service (GPRS) and Bluetooth. GPRS, a first implementation of packet switching within GSM, allows users to send and receive data at speeds up to 115 kbps using Internet Protocol (IP). This service is very efficient in its use of scarce spectrum resources and will allow features such as "virtual permanent connections" to data sources. Bluetooth is a low power radio technology that will allow devices to exchange data at speed up to 720 kbps at ranges up to 30 meters. Bluetooth devices can be grouped into local area subnets. Any system attempting to provide services for mobile

visual communications will need to work within this development scenario of the GSM 3G developments.

What is needed is a way to have a handheld mobile web browser appear to be operating at such a high data rate with such a quick response that it compensates for the Internet traffic congestion. Fast updates of information, a user-friendly graphical user interface and web pages tailored for the small screens must be available in handheld units.

BRIEF SUMMARY OF THE INVENTION

The system needed to support mobile Internet access from extended handheld units centers around two foci, speed and special content. Both of these are served by placing the contents that the user desires as physically close to the user's server as possible. Speed at the support services level is needed to compensate for the cost structure and low bandwidth of wireless communication and the limitations of handheld unit screens. Special content is needed to present the extensive information in readily interpreted formats that complement the speed services. Speed services are located both in the handheld unit and in a custom server for mobile handheld net surfing.

One feature of the novel system is an ability, built into the handheld unit, to create search requests that retrieve precisely the information wanted from the network. Such search requests augment the wide ranging search facility already available and guide the user to precisely defining a need so that the number of hits for that request is limited. Another feature in the handheld

unit is a quick connect service; a service that identifies the user and his authorization as the handheld unit is connecting and the server is providing the first connection. Another feature in the handheld unit is the ability to interpret tags that allow the handheld unit to download only changing data and maintain static data in the local memory.

Speed also implies that the server, the main portal to the Internet for the hand held unit, has specialized capabilities. One of these capabilities is an ability to convert desktop formatted pages to mobile handheld screen format. This may be a straight conversion of one page to a number of screens or a tailored conversion approved by the information provider that optimizes the presentation for the handheld environment. Another capability is a means to access screens tailored for the handheld unit, whether the screens are resident at the server or on other databases accessed by communications including the Internet. Another server capability is handheld communication services assuring that each transmission is quantified to fill an entire screen in the handheld unit and maintaining a running status to enable the communications ride through a wireless service outage. A major improvement in apparent speed comes about because the server is able to directly access an extensive database filled with information that has been selected based on the user's historical usage and projected needs. Such a database avoids the need to wait for the full Internet access to send data to the handheld unit. The database is kept current in real time as the page-based data is updated for the rest of the Internet.

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The server for a particular user is a member of a set of specialized servers tailored for mobile users. High speed interconnects between these servers allow the specially formatted information in one to be available to all. A search engine distinguishes between searches that need to use the Internet and searches that are centered on the set of specialized servers that improve the speed of interaction.

The features that support special content for the handheld mobile user include capabilities to allow content providers to submit updates to their desktop web pages and have that update be formatted both for the desktop and for the handheld screen. The capabilities built into these utilities include the ability to tag dynamic fields, distinguishing them from the static fields in the pages, and reformat the pages to fit on the majority of handheld screens. Similarly, for those information providers who choose not to provide handheld screens on the Internet, but who provide pre-approval, fast custom conversion engines are supplied to improve the speed of screen information access. Grouping information based on the user's access and holding that information in the most accessible storage media is an implemented capability. The ability to convert the general desktop web page to a handheld format is provided, and its use is conditioned on the handheld user's explicit request for the conversion. The ability to apply artificial intelligence techniques to the update of information continues the access improvement after a user initially subscribes to information.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

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Fig. 1 is an illustrative example of a web page designed for a desktop;

Fig. 2 is a block diagram of a system according to the invention to support mobile visual communications;

Fig. 3 is a block diagram of a handheld unit.

Fig. 4 is a functional block diagram of a handheld unit;

Fig. 5 is an illustration of how a speedy search can be organized on the handheld unit;

Fig. 6 illustrates the handheld unit connecting to the server through a wireless network;

Fig. 7 is a block diagram of the speedy connect application;

Fig. 8 is a block diagram of a special web server handling the handheld wireless unit;

Fig. 9 is a flow diagram of preloading the 20/80 RIDB;

Fig. 10 illustrates updating dynamic data from ICPs on the Internet;

Fig. 11 illustrates the update application updating the data stored in the database;

Fig. 12 illustrates how the search engine finds local data;

Fig. 13 is a flow diagram of the search engine logic; and

Fig. 14 is a flow diagram of the habit based learning logic.

Fig. 15 is a block diagram of an extended system according to the invention to support mobile visual communications;

Fig. 16 is a diagram illustrating the regional intelligent linking;

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Fig. 17 illustrates a screen used by the updated mapping window;

Fig. 18 illustrates the use of mapping and GPRS transmitters to provide customized information;

Fig. 19 is a diagram illustrating the types of data that can be stored in a Virtual Personal Database;

Fig. 20 illustrates the relationship of the personal database to the Smart Search capability;

Fig. 21 is a comparison f the data access capabilities of a traditional user and the HHU user;

Fig. 22 is an illustration of shipping streaming video; and

Fig. 23 is a comparison of email displays.

DETAILED DESCRIPTION OF THE INVENTION

As people have become increasingly dependent on e-mail services, remote access to corporate Intranets and Internet-based services, wireless telephones and handheld organizers that provide mobile access to these resources have become increasingly useful tools. However, the emphasis in today's mobile communication industry is shifting from a single senory interaction to multi-sensory interaction with manufacturers incorporating screens and modems into wireless telephones as an optional front end to those phones. The current low data rate for wireless communications will be improved up to 384 Kbps in a few years with the proposed third generation (3G) and Bluetooth technology, global specifications for wireless connectivity. These improvements are designed to allow the wireless devices to operate in a noisy radio environment, to implement a fast acknowledgement and to use a frequency hopping

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scheme to make the link robust. However, even with these improvements, the wireless data rate still limits applications such as web browsing and full motion video viewing.

The requirements for mobile web browsing include a high-data rate, quick response, avoiding Internet traffic congestion, instant access to information, user friendly GUI and web pages designed with maximum information content and less text. The invention uses existing and developing augmentations to today's mobile phone wireless as a basis for services to supply efficient mobile applications such as e-mail, fax, rapid data retrieval, information searching, web browsing of personal and organizational data and real-time massive data presentation.

Fig. 1 illustrates a web page 10 as currently provided to a desktop device. The web page 10 is characterized by extensive use of text, esp. categories designed to suggest areas for exploration and some small dynamic areas 12 where data is regularly updated. Dynamic areas 12 can include headlines, stock market prices or specialized information whose dynamic nature is of interest to a specific user. For a mobile business user such dynamic information could include inventory levels, turn around times or other particular information for his company. The desktop page is further characterized by the capability to present information that extends beyond one screen of data. Scroll bars 14 allow viewing more data and provide the opportunity to scroll down or across in a spreadsheet fashion. These capabilities are a deterrent for a mobile user functioning with a small screen in an unreliable

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communication environment where dropouts can occur at any time. For the mobile user, receiving the needed data in guaranteed single screen increments is preferable.

Industry trends are advancing so that a handheld unit (HHU) that incorporates a wireless telephone, a color video screen, an input mechanism and programmable intelligence will be available in the near future. The invention includes programs running in the HHU and at the server locations to make using the HHU productive and aesthetically pleasing.

Fig. 2 illustrates a system configuration according to the invention for supporting the mobile user in one geographical area, for web-based visual communication. Multiple such configurations are implemented to support users throughout a wide area. The system supports communications from predetermined databases that do not utilize the web as well as web-based visual communication. A mobile user 20 has a small screen and is connected to the network by dial up 21 over wireless communication links. The mobile user 20 is connected to a network that could be an extension of the one used by desktop user 18. On the handheld unit 19, a number of applications, illustrated by the speedy search application 22, run and complement facilities at the server 24 location. The connection from the handheld unit 19 is made directly to an information service provider (ISP) server 24 that distinguishes the mobile user 20 from the desktop user 18. The ISP server 24 provides specific capabilities for the mobile user and allows the mobile user 20 to access all services available to a desktop user 18, such as e-mail service 26 via the Internet 25. Specific to the mobile user

however, are services such as the 80/20 Rule Internal Database (RIDB) 28 which speeds up searches. The database 28 is augmented by a search engine that has access to Internet mobile specific sites 30 and Internet desktop sites 32 that can be converted to a mobile format 34. The search engine further provides Intranet or secure Internet 36 access to specific mobile Internet content provider (ICP) sites 38 that mirror ICP desktop sites 40. Alternately, the search engine accesses the information by providing efficient conversion 42 of the ICP's specific desktop information 44.

The ISP server 24 uses a mapping server 46 to track the location of all local 28, Intranet and secure Internet 36 specific data that has a dynamic component stored in the 20/80 RIDB 28. The mapping server 46 manages the updating of available data. For information that is being stored locally, the mapping server 46 and RIDB 28 provide secure updating using an internal update template 48. Alternatively, the mapping server 46 receives and manages updates across the Internet or Intranet 50 from various update facilities 52 and 54.

Figure 15 illustrates the system with more focus on the wireless network than the inner workings of the system. Wireless gateway 400 provides connection between wireless devices such as a wireless phone connected to a conventional PDA 402 or a wireless PDA phone (HHU) 404. The wireless gateway 400connects to the local server suite 406 that sources the information to the devices. Server suite 406 may be a single system housing the 80/20 RIDB and other services or may be a network of systems that provide the capabilities for the region. The server suite connects to the application module 408 that hosts

all the specialized services of the system. When the server suite and application module cannot provide the needed information, they access the Internet 414 that searches the Web 416 for Web pages or if the user has the privileges, accesses a corporate server 412 through a security gateway 410.

Fig. 16 illustrates the high-speed connections that form the territorial component of the system. The server for each region, such as Hong Kong 420, is tied to related regions, such as China 422, Taiwan 424 and Singapore 426, by high-speed intelligent links 421 using landlines, optical links or high speed wireless connections such as GSM or GPRS. Such links enable the servers in the territory to share data in a transparent manner so that data does not need to be duplicated among them. These high-speed links 421 are not part of the general Internet and data accessed across them does not suffer from the delays that limit the Internet. Similarly, since they are dedicated links, they are part of a private net with no need for security gateways or Virtual Private Net (VPN) protocol on the high-speed interconnects. Some of the regional servers may be charged with maintaining an interconnect 438 with other territories, such as Japan 430, Korea 436, the USA 432 or Europe 434. While these connections 438 are still private interconnects and high-speed, because of the distance and increased processing load, such as translation, to access their data, the effective use of sharing of many parts of these databases is limited.

The block diagram of the handheld unit 19 used by mobile user 20 is shown in Fig. 3. The unit 19 communicates using a radio frequency (RF) signal 60,

received by an antenna and RF receiver 62, that is decoded into either voice or data and control signals by decoder 64. The signals from the decoder 64 are fed to the CPU 66 which also interfaces with and external memory card 68, flash memory 67, display device 84 and interface card 80. The handheld unit 19 retains its speaker 82, display screen and input buttons (not shown) as usually present on a PDA or mobile phone but the handheld unit 19 has greater functionality than either a standard PDA or mobile phone. Once wireless communication is established, the received signals are decoded to determine whether they are audio signals, which are sent to the telephone functionality incorporated in the handheld unit, or digital which then are decoded utilizing the modem portion of the decoder 64. Having extensive memory 68 and the CPU in the handheld unit 19 allows applications to be placed in the HHU for maximum responsiveness and speed.

Because of the vastly improved speeds, GPRS allows use of standard browser applications at the HHU rather than custom applications tailored for the slower communications of the traditional wireless environment. In addition, GPRS allows applications such as streaming video to be utilized by the PDA phone. As illustrated in Fig. 22, the server 24 retrieves the video to be streamed from the dedicated database, in this case the 80/20 RIDB 28. The server breaks the video into packets, for instance P1, P2, and P3 that are sent via the GPRS service 480. The packets are transmitted from the source antenna 140a to other transmitters 140b - 140h as queues dictate. The receiver 140 is able to use the GPRS protocol to reconstruct the video stream from the packets

for the user 19. The high data rates used in GPRS communication allow the transparent reconstruction of the video stream from the packets without the delay that would have been present over the Internet.

One application on the handheld unit is programmed to recognize and interpret HTML and XML formats, the display and command languages already standard for displaying Web pages. This capability facilitates the creation of screens that are a subset of Web pages since the conversion doesn't have to deal in protocol changes. In addition, the WAP protocol is utilized when appropriate for managing portions of the communications for the unit. Fig. 4 illustrates the functionality included in the handheld unit. Handheld unit 19 is centered on the display 92 with speaker 82, memory 68 and modem 64. These devices together allow the decoders for video 94, graphics and text 96 and music 98 to present the decoded result to the appropriate input/output device for the user. The modem 64 further connects to the RF receiver 62 to receive the input over the air from one of any number of mobile servers 100 able to provide the data requested.

A set of alternate configurations are built into handheld units that are equipped with Bluetooth (short distance wireless transmission technology) communications. Some of these handhelds are not equipped with the standard modem and RF receivers for GSM and so cannot access the conventional system server. Others of these handhelds are equipped with both the conventional wireless receivers and the Bluetooth communications and are programmed to function as local servers. These server handhelds receive requests for information from the

Bluetooth-only handhelds and initiate the request to the systems server. When the information is received, it is passed on to the handheld that requested the data. Alternately, the server handheld can function as the link to the system for a meeting where the other participants use Bluetooth handhelds. Only one phone connection will be needed for such a meeting, while all participants can see and manipulate the data.

Another application that is part of the facilities for mobile web surfing is the speedy search application, memory resident in the handheld unit as illustrated in Fig. 5. The search service first presents to the user the types of information the user has typically wished to search for as well as the general alternative. This first menu 110 is adaptable to be customized by the user so that, for instance, business 114 refers to the inventory for the user's business. Once the user has selected an input, in this example, map 112, the next screen 120 further limits the search, offering targets known to be of interest to the user, such as Asian countries, although the option to enter a different location is offered. In the example, option Hong Kong 122 is selected, and a further narrowing of the search is conducted by presenting a menu 130 of features in the Hong Kong area retrieved up from the memory in the handheld unit. While operation is facilitated by storing the search sequences in the handheld unit, at any point the menus for a screen, such as screen 130, could be downloaded to the handheld unit from the server. As the search engine becomes familiar with a user's pattern of searches, it will suggest the best way to formulate a search to get the desired information more quickly. By

using speech as the delivery medium for such suggestions, progress in a menu search will not be lost. Once the user has selected a particular area in the region already chosen, in the example festival walk 132, the search is submitted to the search engine resident on the server.

Because the search is narrowed, the number of hits at the server will be smaller and the number of interactions over the wireless link is minimized. The specific information is provided quickly. When the information requested is found at an ICP providing mobile formats, it is transmitted formatted for the screen of the handheld unit and utilizes symbols rather than words wherever possible. The search engine may be a significant factor in providing a timely response to the speedy search application as will be detailed in the description of the search engine.

Fig. 6 illustrates the connectivity of the handheld unit 19 to the mobile web server 24 via wireless links 140 installed throughout the local reception area. This connection is facilitated by a quick handshake protocol executed by the handheld unit 19 and the server 24, illustrated in Fig. 7. It is important to meeting a 10-sec acknowledgement time goal that the quick handshake protocol is executed at the server rather than by a device further into the Internet.

The connection from the handheld unit 19 incorporates sufficient information, including the wireless telephone number and account codes, to allow the server 24 to recognize the caller 220. Such recognition 220 includes authenticating the user, pre-authorizing the transactions the user has contracted for and establishing the security privileges required by the user. The system

incorporates a security gateway 410, as was shown in Fig. 15, for users that are conducting commercial operations requiring safe and secure electronic transactions such as in the fields of banking, finance, telecommunications, entertainment, health, education and corporate information utilization. The security gateway 410 implements three levels of security - secured socket layer (SSL) connection, password-based authentication and electronic-certification-based end-to-end-encryption. The security gateway is Public Key Infrastructure (PKI) enabled, allowing mobile users to digitally sign and encrypt messages using their personal private key and the designated corporation's public key.

Quick handshake also determines whether there was a recent call that was interrupted 222, where an interruption is defined as not completing a normal sign-off protocol. If there was no interruption, then the user is welcomed 232 and the server awaits input from the user 228. If the previous call was interrupted, the server determines whether a full screen had previously been sent 224. If a full screen had not been sent, then the server repeats the previous transmission 230 and awaits the user's input 228. If a full screen had been sent, then the server sends the next screen in sequence 226 or, if there is no next screen, the server welcomes the user and awaits the user's input 228. By this mechanism, the quick handshake minimizes the obstacles presented by the wireless environment allowing the user to conduct his business with ease. After the connection is established, the mobile web server provides access to specialized capabilities, such as the mobile search engine 144 as well as full access to the Internet 146.

A utility incorporated in the handheld and integrated with the quick handshake application utilizes a digital map of the area provided via Geographical Information System (GIS) and the GPRS capability to locate the position of a user as shown in Fig. 18. The map of the region 450 is augmented with substation locations 452. When the user invokes the map function on the handheld, the GIS information is used to select the area of the map to be presented. This allows the user to request services local to his location such as theaters, shopping or a route between two locations. In addition, the user previews (via a film clip or an animated advertisement) the services offered by these proximate vendors with out need to specify their names. The user may also subscribe to an alerting function based on geographical location such as traffic alerts and weather alerts.

The operation of the mobile web server 24 is illustrated in Fig. 8. The server 24 that incorporates the search engine 144 and a 20/80 RIDB database 28 is connected to the mobile user 20 through the dial-up modem interface 150. Data received from the Internet 156 by the server 24 is converted by a conversion engine 34 from the text page format to the screen based handheld unit format. Because the data on the Internet 156 is in many cases under various licensing agreements, the conversion engine 34 will only be invoked at the specific request of the mobile user 20. Therefore, when the information requested by the module user 20 is found on the Internet 156 the server 24 will send a message to the mobile user 20 inquiring whether the user wishes to have the information converted. Only if the user module 20

explicitly requests a conversion of a specific page will the data from that page be converted 34 to the mobile format. In fact, the data on such Internet pages will be converted as soon as it is encountered, but the converted pages will not be displayed unless requested. This timing allows the conversion to appear instantaneous to the user.

Integral to the operation of the mobile server is a local database 28 built based on the 20%/80% adage - that 80% of the information that is wanted is found in 20% of the sources. The 20/80 RIDB 28 is populated with information as the server is brought up and as mobile users subscribe to the service. Fig. 9 illustrates the flow chart for preloading the 20/80 RIDB 28. As the server is being planned, the general information that will be a priority is determined and loaded in the database 240. Selection of the information will be a local business decision based on experience and the targeted users. Before users are solicited, the geographical information types will be determined 242. Examples of geographical information types are maps, weather, business sponsors, and transportation facilities. As users are enrolled in the service, they provide information on their target geographical preferences 244 (areas and information types) and their specific information needs 250.

A learning web server and tagging browser is utilized to further populate the 80/20 RIDB database. The first time a user accesses a new Web page through the learning server, the learning server memorizes all the detailed information inside the page, placing tags in the page and records the time that the user accessed the

data. When the user returns to the page, the learning server checks the time of the return and whether the page has been modified since the user last accessed it. If there has been a change, the tagging browser combines the new information with the old to present the total page to the user and to update the tagging browser's cache. Since the majority of the page will have been retrieved from the local cache, the speed of access to the Web page will have been improved. The new requests are added to the database 252.

The system continues to monitor highly requested data and updates the 20/80 RIDB 254 as needed. The system further checks the time when the user requests the data. If this type of request happens regularly, or at a particular time, the learning server sets an alert. The alert causes the learning server to access the regularly requested screen data just prior to the user's regular request. In this way, the database is fully updated when the user requests the data and the response time is improved. For screens that are requested frequently, rather than at a particular time, the learning server sets a periodic alert to keep updating the database entry for that screen.

The fields of each screen of information stored in the 20/80 RIDB 44 are indexed and tagged according to common industry practice. The tags identify fields and the time the field was last updated. The objective of the tagging is to reduce the length of transmissions between the handheld unit and the server. As screens are accessed, the system learns and marks static fields. A static field tag indicates to the logic that this field

no longer needs to be checked for updates, further speeding the dynamic data to the user.

Although the tagging logic is located in either the server or the handheld unit, the sequence of operations where it is performed in the handheld unit will be detailed herein. The server identifies whether a handheld unit has processing tags enabled process tags during connection and only expects tag selection communication with a handheld unit so provisioned. In response to a data request from a tag recognizing handheld unit, the server will transmit the tags for a screen rather than the entire screen. The handheld unit compares the tag and last updated time for each field with the tags storedfrom the last time the handheld unit requested this screen. If a field has been updated since it was last requested, the handheld will request the updated field. The handheld will build the screen from the new fields and the unchanged fields still in its memory. If the prior screen is no longer in memory, the entire screen will be requested. Because only data that is not available in the handheld is sent from the server, the screen is built faster and transmission time is less frequently the gating item.

A Virtual Personal Databank (VPD) is a memory area dedicated to a user that functions like a private Web page. Users are assigned approximately 20Mb of space with more available. The VPD is saved associated with the 80/20 RIDB and includes such usually read-only data as user accounts, e-mail addresses, software component identifiers, file servers, printer addresses, Web page addresses, and digital certificates. In addition, more temporary data, such as spreadsheets or documents that

will be needed at a meeting can be filed in the VPD. Because the VPD is treated like the 80/20 RIDB, the mobile user accesses this information whenever needed. Fig. 19 illustrates an organization for a VPD when subject matter is organized by category that maps into the access screen.

The information presented to the user of a PDAphone can originate at many sources. The least customized of these sources are those that exist on the Internet in the form of computer pages. In order to present this data as PDA screens in comprehensible format, the pages must pass through a conversion process and, because of potential licensing issues, the user must explicitly request the conversion. The system provides a general conversion program that interprets the HTML codes of the page and converts each page into multiple screens. The general conversion program is run after the page has been retrieved over the Internet. Therefore, the potential Internet delays and the conversion process both delay delivery of this information. If specific pages of information are frequently requested, the system will learn this habit (as previously described) and spontaneously retrieve and convert the pages. However, the user will still need to explicitly request the conversion before the screens of converted information are presented.

A more HHU adapted information source supplies desktop pages only but participates by preapproving a conversion process. User response time is improved by removing the authorization step and screen quality is improved by the conversion templates. The conversion utility delivered with the system incorporates some

templates that are be further tailored by the information provider. This provides the system with a set of custom conversion templates and a mapping of pages provided to template endorsed by the Information provider. The converted screens are typically not stored locally, but are generated as requested. However, if specific pages of information are frequently requested, the system will learn this habit (as previously described) and spontaneously retrieve and convert the pages.

An associated information provider provides information in both formats - page and screen. In one embodiment, the information provider maintains the page information only at the remote site, but transmits any changes to the system. The screen-formatted information is maintained in a fast-access database, either the 80/20RIDB or a server connected to the central system by Intranet or high-speed communications. The conversion template is applied to each changed page and only the changes to the screens are saved. Since the system maintains these screens, the tagging operation described above can be applied to further streamline operation.

The system maintains its information in screen format. This information, such as local maps, local weather, etc., is stored in the 80/20 RIDB if it is being frequently accessed. Otherwise, it is stored in auxiliary servers proximate to the main system.

Referring to Fig. 8, because much of the data stored in the 20/80 RIDB 28 is dynamic, applications to allow update of the PDA version of the pages are provided to ICPs. The mapping server 46 protects the 20/80 RIDB 28 from accidental corruption. The mapping server 46 includes an index to all screen formatted data unique to

the particular mobile server 24 and a mirror database 152 of all dynamic components of the 20/80 RIDB. Any information to be updated in the 20/80 RIDB 28 is first updated in the mirror database 152 and transferred to the full database 28. An updating ICP logs into the mapping server via a Virtual Private Internet, a secure Internet, or an Intranet 162 as shown in Fig 8. This log-in allows the ICP update access only to the update template for its own data. When the ICP completes the update, it signs off with a password to further validate the transaction. The update is then written into the mapping server memory 152. At a later time, the data is transferred from the mapping server mirror memory 152 to the 20/80 RIDB 28.

Alternately the ICP updates its desktop database 160. It logs into the mapping server and the information and the notice of update 162 is sent to the mapping server 46 over the Internet or Intranet. After the mapping server 46 has verified the ICP, it extracts the changing information and updates the dynamic database 152, This process frees the ICP from updating only a screen database while assuring that the information in the 20/80 RIDB is reliable and identical to the desktop database.

For ICP's not directly connected to the mapping server, an interface for updating is provided as shown in Fig. 10. The ICPs 54 provide updates over a secure Internet 202 to the mapping server 46. The mapping server 46 determines where the data is in the 20/80 RIDB 28 and meters 212 the changes into the database 28 so that response to mobile users is prioritized over information update. The tool used for converting conventional Web

pages to handheld pages is termed the intelligent Update Mapping Window (IUM Window) illustrated in Fig. 17. This tool provides template designs to facilitate initial creation of handheld pages as well as updating of existing pages. It also adds to the database of templates in accordance with the behavior of the designer using the tool. A IUM Window 440 for a particular type of screen is shown in Fig 17. It includes a preview area 442 which shows the handheld screen view of the information, a headings area 444 to prompt inputs, an input area 446 for entering text and an image file area 448. Other templates could include areas for graphics, moving image input, and interaction areas. Each time a new type of screen is created, a template is saved associated with its particular designer or content provider. In addition to adapting to the format needs of the content, the IUM Window checks all designed screens for conformance to the target handhelds. Such checks will include check on the size of total page, the size of video content, and the interactions expected when a users views the screen. The IUW Window runs in a number of locations in the network including, on the Internet, the Intranet and in a VPN.

As shown in Fig. 11, For data that is sourced from the ISP server itself, an internal update template 48 is utilized. This update does not require the mapping server, but passes data directly into the 20/80 RIDB 28, whereas external ICPs 54 update using a provided update mapping window 210 before the information is passed through the network 36 to the mapping server 46.

The 20/80 RIDB 28 is the fastest source to satisfy a request from a mobile user. However, all information cannot be stored in the 20/80 RIDB 28. The Internet is

known to have delays due to routers, bridges and its length, therefore each mobile server incorporates an Intranet connecting it to selected mobile ICP servers. Such servers include those providing data from the corporate Internet and the personal data bank. Fig. 20 illustrates how the smart search for information 460 checks the personal database 462 and local databases 464 before checking other regions 466. Checking other regions will include checking the databases for each locale in the region 468 before proceeding to other territories 470. Searching on the Internet will be fit into this sequence.

The search engine 144 tracks where information is to be found and selects the fastest route to the information. As shown in Fig. 12, the site for an ICP 44 can be on the same Intranet 36 as the mobile server 38 or on a secure Internet. In one form, the information is formatted in screens 38 for the mobile user, where the screens reflect the information 40 available to the desktop user. Alternately, the desktop information 44 is the only information directly available, but an efficient conversion engine 42 will provide the information formatted for screens. The advantage of the efficient conversion engine 42 is that the ICP has authorized the conversion of the desktop information, so the user does not have to specifically request the conversion.

The search engine, optimized for wireless communication, is shown in Fig. 13. The speed search application is the front end of the search engine. Once a search request is received, the sequence of search is as shown. The search engine first looks in the 20/80 RIDB 28 for the desired information 264. Because there is no

network access needed to retrieve data from the 20/80 RIDB 28, this is the quickest access. The next preferred information sources are the ICP mobile sites on the local Intranet 266. After the local ICP mobile sites, the desktop sites provided with efficient conversion engines are the next preferred 268. If the information has not been found in the locally connected sources, a search on the Internet is initiated 270. The results of this search are further analyzed, with the responses from networked mobile servers 272 preferred over the efficiently converted database 274 or the standard Internet information 276 after requested conversion. In each case, the search engine returns a screen to the user, or tells the user that the information cannot be found.

As the search engine 28 learns which desktop Internet sites are frequently accessed, it will periodically access the site, convert the data and store it in the 20/80 RIDB. The user will still need to specifically ask for a conversion, but will not have to wait for the information to travel the Internet after making the specific request.

The coverage of the 20/80 RIDB 28 is extended based on an analysis of behavior habit logs (BHL) of each user as illustrated by Fig. 14. On an ongoing basis, each URL accessed via the Internet is logged in the BHL database 300. At predetermined intervals, based on user requirements and variables such as performance guarantees, the BHL database is analyzed for categories such as frequency of visits to a URL and time of access to a URL. For each category that exceeds a predetermined threshold level, responsive action, such as storing the dynamic component of the URL, is initiated 304. For each

category where the high usage is time dependent, a time-based fast storage is initiated. In addition to analyzing URL accesses to add data to the 20/80 RIDB, the accesses to the 20/80 RIDB are analyzed to find categories having significant changes from previous usage levels 306. The BHL log analysis is stored as a summary by user as a baseline for the next analysis 308.

Rather than permanently filling the 80/20 RIDB, the system builds on the habit learning to execute a process of just-in-time access of data. This process consists of a Data Mining (DM) phase and a Data Warehousing (DW) phase. In the DM phase, the process monitors each user's Web surfing as described above, building a surfing profile including URL's accessed, time of access, and interval between requests etc. Periodically, the mined data is analyzed to find patterns that are too infrequent for permanent 80/20 RIDB storage but sufficiently predictable to trigger the DW phase. In the DW phase, Web sites that are expected to be requested at a certain time are prerequested and stored in local servers to improve the perceived response time. This process is also used to push unrequested data that is predicted to be "interesting" to the user at inactive times.

The types of E-mail that are supported by PDA phones is more extensive that for other technologies that have traditionally been limited to approximately 100 character messages. PDA phones support messages of unlimited length because the screens are seamlessly refreshed, support the attachment of files such as Spreadsheets, documents, pictures, video files and audio. The graphical and video support in the PDA phones allows full communications of the relevant messages.

Fig. 23 illustrates the contrast between the text displays on a mobile telephone 520, the display possible under WAP 522 and the display on the HHU 524. The graphical presentation of a map 524 makes it possible to convey not only the directions to a location, but the relative distance, alternate routes, and services available on the routes. Similarly, the email on a text display 526 provides no security and presents the mail in a sequential fashion. While the WAP email 528 allows some security provisions, its display is too limited to format the mail displays. In contrast, the HHU email displays 530 provide for security 532, display of the pending messages in an organized format 534 and prompted sending of messages and replies 536 that are convenient to work with.

Two examples will illustrate the improved services possible by combining the advances in wireless communications technology with the invention: On-line Race betting and on-line stock trading. Each of these applications requires preliminary actions to allow swift completion of follow-on actions. The user must know that they will be within the network, or roaming extension to the network, range. This limitation is a liberal one when the territorial communications support as previously described is implemented. The user then needs to register for the type of information desired - registering with the racing database or the various stock databases available including the databases specifically supporting the invention. The last preliminary step involves establishing accounts to permit transactions - betting or trading. The security provisions of the invention assure

that these transactions are accomplished reliably and securely.

The contrast between the traditional ways of conducting these activities, today's ways of doing them and the way they are conducted with the HHU are illustrated in Fig 21. Each application will be examined separately. For the traditional user, building the background data on a race so that there is am acceptable probability of winning involves reading the history of the horses and the track in newspapers 508, watching races at that track or of a horse of interest on television 510, and discussing the observances on a telephone 512. A lot of the activities happening in conjunction with the race (trial runs, training gallops, etc) are not converted into information for the traditional user. The analysis available is what the newspapers offer, or that which the traditional user puts together. As the time of the race gets closer, the only way to get further data is to go to a specialized location (the track or a betting parlor). The actual bet is placed either in person or via telephone with a bookie that has accepted the bettor's account. The traditional user finds out the result of his bet by watching the race, calling the bookie or reading the paper the next day.

Today's user has additional resources available to him. If today's user stays at the computer 506, they can access data about the race and horses through the Internet Service Provider 502 right up until race time. On-line betting requires an account, and security precautions, but is available. With the high data rates available at a connected station, streaming video could

provided of training runs and of the race itself but is not currently available. The computer also allows the today's user to analyze the data available - to find trends and advantages. The deficiency for today's user is the fact of needing to stay at the computer. Many people need to move around to accomplish their jobs and so cannot use the facilities of the land-line connect computer for their hobby.

The HHU user has all the advantages of today's user with the mobility required for business conditions. In addition, the invention allows for mechanisms that make keeping up with racing efficient. The user preselects what information they want to receive. When new information in those categories is available, the user is alerted and the information is selectively downloaded into the HHU for ready access. The availability of streaming video allows the mobile user to see both the race and the practice runs on the HHU. As race time approaches, the user receives the most current data on betting patterns, odds and track conditions.

For the trading application, the traditional user gets primary stock information via paper sources - newspapers, analysis' reports, and company filings. The traditional user is kept up-to-date by television reports, subscribing to services or telephone conversations with brokers. The quality of information suffers from a time lag between release to the professional trading community and the non-professional trader and the fact that analysis is either slowly developed or available to most preople. The actual trade is placed via telephone, either to a person or via a

keyboard activated capability. Confirmation is via phone call or mail delivered in a few days.

Today's user utilizes the connected computer to expand each of the activities of the traditional trader. News stories, company filings and analysis are accessed on-line, Broker recommendations, from more than just the trader's broker are listed on-line. Minute to minute movements of the stock price are also available. On-line trading provides instant access and immediate confirmation of trades.

The PDA user has the same advantages as today's user with the added advantage of mobility and the features of the invention. The user's custom programs are readily available. and the user is alerted when events of interest happen.

For both of these applications, the invention provides improved response time due to the expedited personal verification procedures, improved access to data and action possibilities and a high level of security even in the face of the wireless communications being used.

Having described preferred embodiments of the invention it will now become apparent to those of ordinary skill in the art that other embodiments incorporating these concepts may be used. Accordingly, it is submitted that the invention should not be limited by the described embodiments but rather should only be limited by the spirit and scope of the appended claims.

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